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Utilizing Large Language Models in Tribal Emergency Management

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This paper explores the unique challenges faced by tribal communities in the context of emergency management, encompassing natural disasters and the preservation of their rich cultural heritage. The study aims to investigate both the potential advantages and hurdles associated with the adoption of large language models (LLMs) in tribal emergency management. Our primary goal is to qualitatively assess Indigenous perspectives on the suitability and acceptability of deploying an LLM-powered chatbot in this specific domain. To achieve this objective, we employ a think-aloud interview methodology involving 18 tribal members. This qualitative research approach captures participants' cognitive processes and decision-making as they engage with the language model's responses in real-time. Through thematic analysis of these verbalized thoughts and the prompts submitted, the study sheds light on various aspects, including usability, information-seeking behavior, and the incorporation of tribal culture considerations when integrating large language models into tribal emergency management practices. The paper concludes with a discussion of potential design implications and contributions to the fields of AI and HCI.

CCS Concepts: • **Human-centered computing** → **User studies**.

Additional Key Words and Phrases: ChatGPT, Indigenous, Think-aloud

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INTRODUCTION

Indigenous communities have grappled with substantial challenges resulting from natural disasters. Over the past decade, tribal lands in the United States have been affected by more than 70 natural disasters, with certain communities enduring multiple catastrophes within a single year [12]. Climate change exacerbates these issues and has the potential to render tribal lands uninhabitable, disproportionately affecting Indigenous communities the most amid global climate change challenges [8]. For instance, the tribal reservation lands along the Missouri River were constantly hit by flooding disasters, including multiple tribes in Nebraska and South Dakota [7]. The lack of adequate funding from state or federal government entities poses a substantial challenge for Indigenous communities and their lands. It's difficult for tribal nations to get money from the government because they find it hard to show proof of their expenses or contributions when they ask for reimbursement or to share costs. [5, 19].

The utilization of chatbots for enhancing emergency communication, documentation, preparation, and response has been extensively examined in crisis management and HCI research [13, 14]. In our previous study [19], we explored the effectiveness of using an AI chatbot to assist the tribal nation in better managing and reporting natural disasters to local officials. Our study supports the feasibility of using chatbots in tribal emergency management. Nevertheless, the conversational approach to chatbot design is often constrained by training data and technical challenges in comprehending the diverse intentions of users. This limitation could restrict the chatbot's ability to discern users' intentions and provide customized, valuable, and practical emergency management information and recommendations [6]. The emergence of large language models (LLMs) signifies a significant milestone in natural language processing (NLP), as they are capable of generating human-like text, providing highly accurate language-related answers, and performing language-related tasks

effectively [9]. The development of LLMs paves the way for novel human-AI interactions and the potential adoption of this technology in the context of tribal emergency management [15].

While AI and LLMs offer new opportunities for developing solutions for tribal emergency management, it is imperative to consider ethical considerations, incorporate indigenous knowledge systems, and tackle the unique challenges faced by these communities [17]. For instance, one of the most widely used LLMs services, ChatGPT, may not comprehensively incorporate representations of marginalized groups, including elements related to culture, language, and values within indigenous communities, in its training dataset [11]. Furthermore, disaster and emergency management in indigenous communities necessitate a distinctive approach that considers their unique methods of coping with their culture and sovereignty [3]. There remains a significant gap in research concerning how underserved populations, such as tribal communities, perceive new LLMs technologies and how they can effectively customize these technologies to better align with tribal customs and cultures.

The aim of this study is to qualitatively assess Indigenous people's perspectives on the suitability and acceptability of employing an LLM-powered chatbot in the context of tribal emergency management. We seek to address the following research questions: 1) What are the user experiences when utilizing LLMs within the realm of tribal emergency management? 2) How can the use and development of LLMs better align with the values and culture of Indigenous communities? In order to address these research questions, we organized think-aloud interviews and extended invitations to participants (N=18) from the Omaha Tribe of Nebraska to interact with ChatGPT. The main aim of these interviews was to capture participants' experiences and collect their insights concerning the utilization of LLMs in tribal emergency management within a natural and non-intrusive experimental setting [10]. Applying a thematic analysis approach, we showcased the prompts participants used during the interviews and identified three primary themes based on their verbalized feedback, encompassing usability, information needs, and cultural considerations.

This paper's contribution can be categorized into three key aspects. Firstly, we gathered and presented empirical evidence derived from an on-site user study, with a focus on a marginalized population. This enabled us to assess their perceptions and experiences with state-of-the-art LLM technologies. Secondly, we delved into the design implications of integrating

LLMs into tribal emergency management and user interface designs. Thirdly, our work emphasized the significance of raising awareness about LLMs within communities that have limited exposure to such technologies, as well as the importance of preserving tribal culture and customs.

METHOD

To address our research questions, we employed a think-aloud interview methodology to delve into the utilization and user experience of ChatGPT within an indigenous community for emergency management purposes. We adopted an active intervention method that invites potential users to execute a series of assigned tasks while consistently articulating their thoughts throughout the task execution process [1, 20]. This method effectively combines cognitive laboratory interviews to capture verbal reports and the participants' psychological engagement with the interventions [16]. We find this approach aligns well with Indigenous research methods that enable tribal participants to think critically and provide authentic feedback [10].

The research was conducted at a community center situated within the Omaha Tribe of Nebraska. The Omaha tribe, referred to as *Umoho* in the Omaha-Ponca language, is a federally recognized Native American tribe residing on the Omaha Reservation in northeastern Nebraska and western Iowa, United States. The tribe comprises a total of 5,427 enrolled members, as documented by the Bureau of Indian Affairs¹. Our research team, consisting of three faculty members and five graduate students, traveled to this Indian reservation land to facilitate the study in October 2023. Two of our research team members are of American Indian heritage and possess personal connections with local emergency managers and tribal members. Before conducting the on-site study, the research team contacted the Tribal Nation and shared an invitation outlining the study's details, including the study goal, plan, location, and agenda. We relied on their

referrals to enlist participants for our study. Before initiating recruitment, we secured approval from our university's human subjects Institutional Review Boards (IRBs). This study received an official resolution from the Omaha Tribal Council, endorsing our research team's proposed study.

A total of 18 participants participated in the study, and their demographic information

(occupation, gender, and age) is presented in Table 1. The user experiment began with a 15-minute group presentation, which explained the concept of employing an AI chatbot for reporting natural disasters and explained the study plan and procedures. This presentation was delivered using a projector and slides, and a simple chatbot design screenshot was introduced in the context of tribal emergency management. Following the presentation, all attendees were encouraged to join designated study stations within the meeting room, each equipped with a laptop and one research team member (i.e., facilitator) to facilitate one-on-one think-aloud interviews. The primary aim of these interviews was to elicit the participants' experiences and ideas regarding using ChatGPT in tribal emergency management. A total of four graduate students were responsible for hosting these study booths and inviting participants to their respective booths for testing and interviews. The participants did not receive compensation for their involvement in the study; however, the research team arranged a post-experiment lunch as a social event to promote conversation and social interaction.

¹ Source: <https://www.bia.gov/regional-offices/great-plains/nebraska/winnebago-agency>

Each think-aloud interview began with a brief introduction to ChatGPT, followed by the facilitator presenting a list of sample prompts for participants to try typing and review ChatGPT's responses. These sample prompts included questions like "*Can you provide information about the Omaha tribe?*", "*My house has flood damage; what steps should I take?*", and "*How can I protect myself and my property from natural disasters?*" Participants were also encouraged, not obligated, to input their own questions for ChatGPT. If participants faced difficulty typing or preferred assistance, the facilitator helped with the input and reviewed the responses. Ten participants asked at least one follow-up question (as indicated in Table 1). The facilitator posed additional interview questions during the testing to collect verbalized feedback, such as "*How do you like the app?*", "*What improvements do you think would enhance the app's usefulness?*", and "*How can the app better incorporate Indigenous culture?*" The interview duration ranged from 10 to 30 minutes. To ensure accessibility for all participants, we utilized a free version of ChatGPT (GPT-3.5) and its standard conventional agent. Following the experiment, our research team reviewed these recordings and transcribed them into text transcripts.

Table 1. Demographic Data of the Tribal Participants

PID	Title	Prompts	PID	Title	Prompts
P1	Cultural Resources Specialist (M, 50-60)	3	P10	Program Director (M, 40-50)	2
P2	Tribal Judge (M, 50-60)	8	P11	Attorney General (F, 40-50)	20
P3	Program Director (F, 30-40)	4	P12	Public Safety Director (M, 30-40)	2
P4	Emergency Manager (M, 30-40)	4	P13	Program Director (F, 40-50)	3
P5	Tribal Historic Preservation (F, 40-50)	2	P14	Chief of Tribal Operations (M, 50-60)	1
P6	Tribal Council (M, 60-70)	2	P15	Policy Attorney (F, 30-40)	2
P7	Transit Coordinator (F, 30-40)	6	P16	PhD student (F, 20-30)	3
P8	Agricultural Monitoring (F, 40-50)	2	P17	Agricultural monitoring (M, 40-50)	4
P9	Construction Manager (M, 30-40)	1	P18	Public Safety Director (M, 40-50)	5

Subsequently, we adopted a thematic analysis approach to analyze the interview data and the prompts submitted by the participants, with both authors of this paper participating in the analysis [4]. Two authors of this manuscript engaged in iterative discussions to refine and develop overarching and salient themes pertinent to chatbot design, emergency management, and user experience. To protect participants' privacy, all identifiable personal information was carefully redacted. Throughout the preparation and execution of the study, we were mindful of the ethical considerations involved in working with vulnerable populations.

FINDINGS

Prompts Analysis

We examined a total of 47 prompts submitted by the participants, included in Appendix A.

Participants sought information related to **tribal origins, governance**, and emergency management within the context of the Omaha Tribe of Nebraska and the Winnebago Tribe (a nearby tribal nation in Iowa). There was an inquiry about the historical location of the Omaha Tribe and whether they originated from Ohio. Additionally, questions centered around the place of origin of the Winnebago Tribe. Regarding the Omaha Tribe, participants inquired about their judicial system and whether they have an emergency manager. These questions highlight an interest in the history, governance, and organizational structure of specific Native American tribes, emphasizing the importance of understanding their background and administrative aspects. Participants submitted prompts for **informational purposes**, including individuals, historical events, food preferences, and natural disasters. Participants sought information about the 2019 Missouri River flood [7], its date of occurrence, and its impact on the Omaha Indian Reservation.

Furthermore, inquiries were made about Nebraska's seismic history, the largest recorded tornado in the state, the classification of a tornado in Beemer, Nebraska, and a tornado event in Macy, Nebraska.

A broad spectrum of questions related to **emergency management** focused on preparing, protecting, and seeking resources during an emergency. Specifically, these queries ranged from seeking guidance on managing flood damage and understanding FEMA's assistance programs to unrelated topics such as PHMSA pipeline protocol, tribal demographics, and even personal health emergencies. Some participants were interested in pre-disaster mitigation programs and Hazard Mitigation Planning, while others sought information on specific emergency scenarios, including thunderstorms, ice storms, earthquakes, tornadoes, and active shooter situations. These questions highlight the diverse range of information needs and concerns among users, emphasizing the need for a versatile and adaptable AI system capable of addressing various inquiries across different domains and emergencies. In this category, a series of questions regarding **government involvement** with tribal communities and disaster relief funding were posed. Participants were interested in whether FEMA grants were available to tribes, specifically inquiring about the Omaha Tribe of Nebraska and their eligibility for disaster relief funds. Additionally, there was curiosity about the existence of an updated Mitigation Plan for the Omaha Tribe.

Participant Experience Analysis

Our final thematic scheme included three primary categories of the participants' experience in using ChatGPT in the context of tribal emergency management.

Knowledge and Concerns over ChatGPT. During the think-aloud session, participants found ChatGPT's responses intriguing but did not fully comprehend how this AI chatbot operated. Only a few participants were familiar with ChatGPT and had interacted with it previously. Throughout the think-aloud session, the facilitators explained that ChatGPT was an AI chatbot capable of answering questions using natural language. Based on this explanation and their interaction with the model, they developed a mental model of what ChatGPT is and compared it to more familiar applications, such as the Google search engine and conversational agents like Siri, which also serve the purpose of providing answers to user questions. Participants also inquired about the distinctions between them.

“what is the difference between this and Siri?” - P10

In the quotes above, P10 expressed curiosity about the difference between posing a question to Siri, Apple’s conversational agent, and ChatGPT after examining ChatGPT’s response to the question of *‘Can you explain what FEMA is?’*. These findings underscore the importance of raising awareness about LLM chatbots and their operation, particularly in communities with limited knowledge or exposure to such technologies.

Participants generally found ChatGPT easy to use and consistently provided detailed responses to their prompts. Participants particularly appreciated the detailed responses when asking more generic questions. Their curiosity about the chatbot prompted them to experiment with various prompts and assess the model’s usability. As an example, one participant intentionally entered misspelled words to test whether ChatGPT could comprehend the query and generate an appropriate response.

“Let us see if it will know what I’m saying, if I mistyped it like that? Because that’s going to be people are going to do that a lot for treating a severe one.” - P11

A significant insight from the study, in the context of emergency management, was the concern regarding the digital divide during emergency situations and the accessibility of chatbots like ChatGPT, which may involve network and connectivity issues. Participants questioned how individuals without internet access would reach such a chatbot in emergencies. Furthermore, even with internet access, there were queries about ensuring the chatbot and its information were visible to people residing in remote areas.

“The challenge is that a lot of our people don’t get this information. Even with a tornado this afternoon, people don’t know about the FEMA. [...] How we get that information to our people in remote areas is my question.” - P14

Concerning the issue of accessibility, participants noted that beyond internet access, the chatbot interface could serve as an effective means for people with specific disabilities to access emergency information. For instance, in the following quote, a participant suggests a potential benefit of chatbots for individuals who are hard of hearing. They propose that an emergency-responsive chatbot could automatically initiate an emergency call on their behalf.

“So I’m thinking this might be really useful if someone can’t speak or their hearing is so low that making one call is going to be effective or efficient. So are there certain things that someone could put in this chatbot that would trigger either an electronic call or

something going to a real person dinging them to say, hey, this person can't make that 911 call, that would be useful. If there was something that it called for then like I can't call 911, can you call for me?" - P11

Information Needs for Tribal Emergency Managements. The participants liked the responses provided by ChatGPT but found them to be a bit too generic and long. The long responses can be particularly overwhelming during an emergency situation. All participants pointed out that it would be helpful if the chatbot could provide more specific responses curated for their community.

"They may have more detailed information, so it would be nice to have that specific frame and those, I think, are available with the National Weather Service. So it should be updated in this also." - P2

In the above quote, P2 suggested that having more precise and more current information would be helpful. ChatGPT's knowledge was cut off in September 2021, and hence it does not have updated National Weather Service data to provide specific and accurate information. Moreover, when asked about the Omaha tribe, ChatGPT's response would often leave out important details about important treaties, land history, and the movement of Native American communities over time. These details are significant to understanding and appreciating the uniqueness of their area. For example, in the quote below, the participant provides a scenario to elucidate the importance of a specific response. The participant finds it intriguing that despite having different names for the same place, different groups or individuals essentially refer to the identical area. This highlights the cultural diversity and history of the region, where different communities may have assigned names to the same spot over time.

"like one thing I noticed, cause I'm the land manager, and I talk to the local farmers and producers. We're discussing the same geographical region, but there's a unique way we pinpoint it, almost like identifying it differently despite being one and the same. It's intriguing because this location goes by two names. One name is "Somebody's Corner," while the other is "Someone's Corner." It's fascinating that despite the distinct names, they refer to precisely the identical place. So, in essence, we're essentially talking about the same area, albeit with a different name." - P13

Some specific ways the participants wanted the response to be tailored to their culture and customs was by embedding existing community social media pages into the chatbot. Social media

pages, such as the tribe's Facebook page, could serve as a central location for the chatbot to post the information. This way, the chatbot would be able to answer people's questions effectively and would make a valuable resource for providing information beyond just emergencies, such as food security concerns and food distribution information. This illustrates the broader utility of the chatbot for addressing various community needs.

"But maybe Emergency Management doesn't always, you know, because, you know, food security can be a concern sometimes. And if we know, hey, there's a pass out lunch at such and such place, if somebody says I'm hungry, we're gonna get food today and it can be seen on our webpage, hey, we'll get a meal. You know, stuff like that. Like, will it answer those kinds of questions even though it's not really an emergency question?" - P11

Tribal Culture and Customs and Large Language Models. The tribe's culture and customs are very important to the Omaha tribal community. Recently, the tribe members have faced concerns and challenges in preserving their cultural heritage, language, spirituality, and traditions in the face of external influences from the Western world.

"I would say that Omaha tribe lost some extent of Culture, Language, Spirituality and tradition and it's been deteriorating from the past two generations. And lost some of its identity with the impact of western world. And got impacted and weakened the existence as a sovereign nation" - P12

This also highlights the broader impact on their identity and status as a sovereign nation. Hence, the way this culture is represented in a large language model chatbot is critical in this community.

"It is missing, like the idea of the climate crisis, and how a lot of these intensified storms occur and environmental degradation is missing. [...] Here it could say something extra about environmental protection and land resources and things like that. Overall, I don't think it's really helping out the tribal people." - P16

The quote above shows how significant local environmental resources are to the Omaha tribe. ChatGPT's response to the participant's question *'How can I safeguard myself and my property from natural resources?'* was very generic and did not consider the tribal customs around natural resources protection and management. The participant suggests that the chatbot could be improved by providing more information about environmental protection and the growth

of trees. They seem to believe that the chatbot has the potential to provide information and resources related to environmental protection but is currently falling short of its potential impact.

“FEMA has lot of criticisms, how there will be relationships from FEMA, other governments and tribal governments and it’s a positive stuff which is good, but it is missing controversy of how it had issues in the past or current.” - P16

Similarly, there are a lot of complex social and political aspects of the tribe that need to be accurately represented in the responses provided by the chatbot. For instance, FEMA (Federal Emergency Management Agency) has established relationships with various governments, including tribal governments. These relationships are seen as a positive development. However, it has faced a lot of criticism. Participants felt that there was a perceived gap or missing element in the response generated by ChatGPT about FEMA, where there is a lack of discussion about the controversies and problems FEMA may have encountered in the past or is currently facing.

DISCUSSION

This study aimed to understand the Omaha Tribe’s views on implementing ChatGPT in tribal emergency management. Through think-aloud interviews, we gathered insights and requirements for a community-tailored chatbot. Participants found ChatGPT user-friendly but sought more customized responses, especially during emergencies. We showcased user-generated prompts and highlighted the need for awareness about LLM chatbots in communities lacking exposure to such technology. Our findings stress the importance of preserving tribal culture in chatbot responses, addressing concerns about the digital divide and emergency accessibility. Overall, this study explores challenges and opportunities in deploying culturally sensitive LLM chatbots for emergency management.

Our study supports the adoption of emerging technologies like GPT-powered chatbots in tribal emergency management and climate-related disaster responses. We highlight a new dimension: cultural sensitivity [18]. Tribal participants stress the importance of addressing tribal-specific information, which affects their trust in the system. Solutions may include improving internet access for LLMs or tailoring data with tribal-specific information. ‘Data sovereignty’ is crucial, allowing tribes to control their cultural data [2], respecting their autonomy and

preserving tribal heritage.

In terms of design implications for integrating LLMs into tribal emergency management and user interface designs, several considerations arise. Firstly, integrating with a common information-seeking portal or social media platforms used by tribal communities, such as a website, and offering a web agent along with information could facilitate better access to information for tribal people. Implementing this approach could alleviate the challenges associated with disseminating information to tribal residents, eliminating the need for them to make phone calls to the emergency manager's office. This would prove especially beneficial during or in the aftermath of natural disasters. Secondly, responses should prioritize cultural sensitivity to acknowledge power dynamics with other authorities. Additionally, there is a need to educate or assist potential users on how to formulate proper prompts to engage more effectively with the responses generated by LLMs.

A significant limitation of this study is its exclusive focus on one tribe, whereas Native American nations span diverse geographic regions. To ensure the credibility of insights and design implications in emergency management, gathering insights from various tribes is crucial. Another major drawback is the power imbalance in the conducted user study. Acknowledging the ethical considerations when working with vulnerable populations, the authors have begun establishing long-term collaborations with tribal nations in the Midwest region of the United States.

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A APPENDIX

Prompts for the different categories:

A.1 Tribal background and history

- Was the Omaha tribe originally from Ohio? (P17)
- Where is the Winnebago tribe from? (P17)
- Does the Omaha tribe of Nebraska have a court system? (P2)
- Does the Omaha tribe of Nebraska have an emergency manager? (P2)

A.2 Informational

- who is Marisa fuller? (P13)
- What month was the Missouri River flood of 2019? (P2)
- What date did the Missouri River flood the Omaha Indian Reservation? (P2)
- Who makes the best fried chicken? (P3)
- Give me the places? (P3)
- Has Nebraska ever had an earthquake? (P11)
- What is the biggest tornado recorded in Nebraska? (P11)
- What classification was the tornado that hit beemer, Nebraska? (P11)
- Do you know about the tornado in Macy, Nebraska (P11)
- Can you give information about the tornado's in 2009? (P11)

A.3 Emergency management

- I am the office manager and my office flooded, what steps should I take? (P15)
- Who should I contact when dealing with flood damage? (P15)
- Can you give more about pre-disaster mitigation program (P18)
- Explain about Hazard Mitigation Planning? (P18)
- Show an example about risk assessment?(P18)
- Give information about fire management?(P18)
- How does the FEMA help an individual?(P14)

- Who should I contact when dealing with flood damage? can you explain in more detail?
(P1)
- What is the phmsa pipeline protocol? (P1)
- What is the population of the Omaha Tribe of Nebraska?(P2)
- Where is the Omaha Tribe of Nebraska located? (P2)
- Who to contact for Thurston county emergency ? (P3)
- How do I fix my house with roof damage? (P4)
- How do I prepare for a Thunderstorm? (P4)
- what to do when there is an ice storm (P7)
- What to take care during a community evacuation (P7)
- what to do during an earthquake(P7)
- Can you tell something about emergency contingency plan? (P7)
- There is a tornado where can i seek safety (P11)
- My home is no longer safe. where can i seek shelter (P11)
- I need an ambulance (P11)
- I burned my hand severely what should i do (P11)
- my husband is having a heart attack send help (P11)
- Call the emergency (P11)
- I can't speak how can I call in an emergency? (P11)
- What to do when in the dangerous air quality regions? (P11)
- what to do when there is an active shooter around? (P11)
- what to do when you are in a bear attack threat? (P11)
- what to do when there is no food in the region due to any natural disaster or issue? (P11)

A.4 **Government related**

- Does FEMA award grants to tribes? (P18)
- Has FEMA ever provided disaster relief funds to the Omaha tribe of Nebraska?
(P2)
- Does FEMA have an updated Mitigation Plan for the Omaha tribe of Nebraska?
(P2)
- is it possible to obtain a recovery fund from fema? (P4)

